Stronger Housing, Safer Communities: Strategies for Seismic and Flood Risks

Association of Bay Area Governments

Bay Conservation and Development Commission

Goals of the project:

- Better understand the vulnerability of housing and communities to earthquakes and flooding
- Identify potential consequences on existing communities and in areas projected to grow
- Develop risk reduction strategies that increase resilience, sustainability, prosperity, and equity
- Share findings with jurisdictions throughout the region, the state, and the country

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Why focus on housing and communities?

- Recovery after a major hazard event depends on whether people are able to stay in their homes
- To improve recovery we need to better understand which housing and communities are most at risk
- Knowing these risks informs the selection of resilience and recovery strategies and helps make the case for taking action

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Collaborative by design:

Project Leads
ABAG's Resilience Program
BCDC's ART Program

Advisory Committee
Experts in hazards, housing, and community vulnerability

Bay Area Stakeholders
Local agency staff, decision makers, non-profits, academics, interested community members

Strategy Consultant
AECOM

Funders
USGS, US EPA
FEMA, SGC

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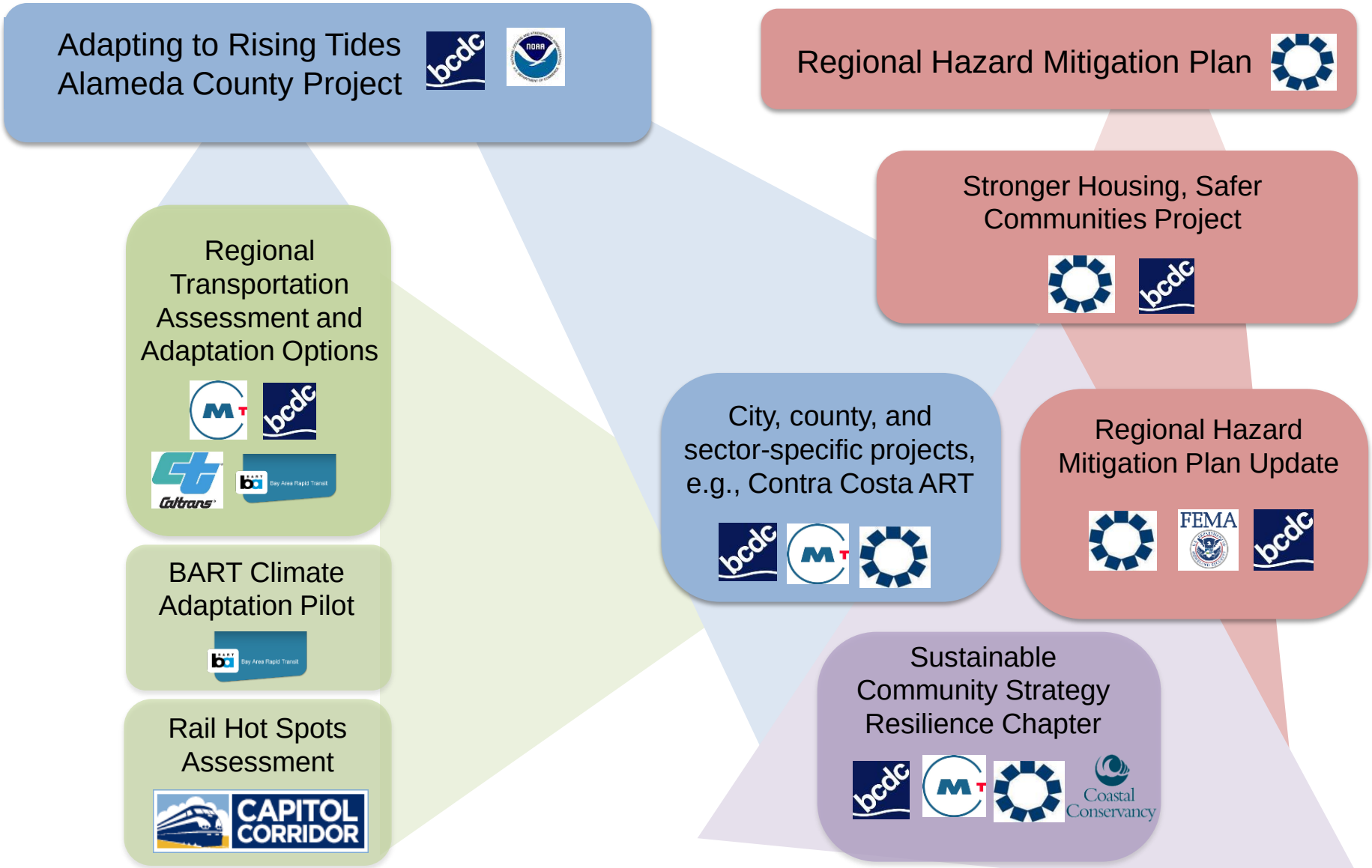
Integrated with other resilience projects



Assessing housing and communities at risk:

Hazards

Seismic and flooding, and the intersection between

Three hazards

- Ground Shaking
- Liquefaction
- Current and future flooding

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Fragile Housing

Housing with characteristics that make it likely they will be damaged in areas potentially exposed to ground shaking, liquefaction, current or future flooding

Eight housing types

- Single family cripple wall
- Single family house over garage
- Unreinforced masonry
- Multi-family cripple wall
- Multi-family weak story or open front
- Multi-family non-ductile concrete
- Insufficient foundation for liquefaction
- Any house in a flood zone

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Communities at Risk

Individuals, households and neighborhoods with characteristics that make them less able to prepare, respond or recover

Ten community characteristics

- Age
- Education
- Household income
- Race/culture
- Non-English speakers
- Home ownership
- Housing cost burden
- Transit dependence
- Transportation cost burden

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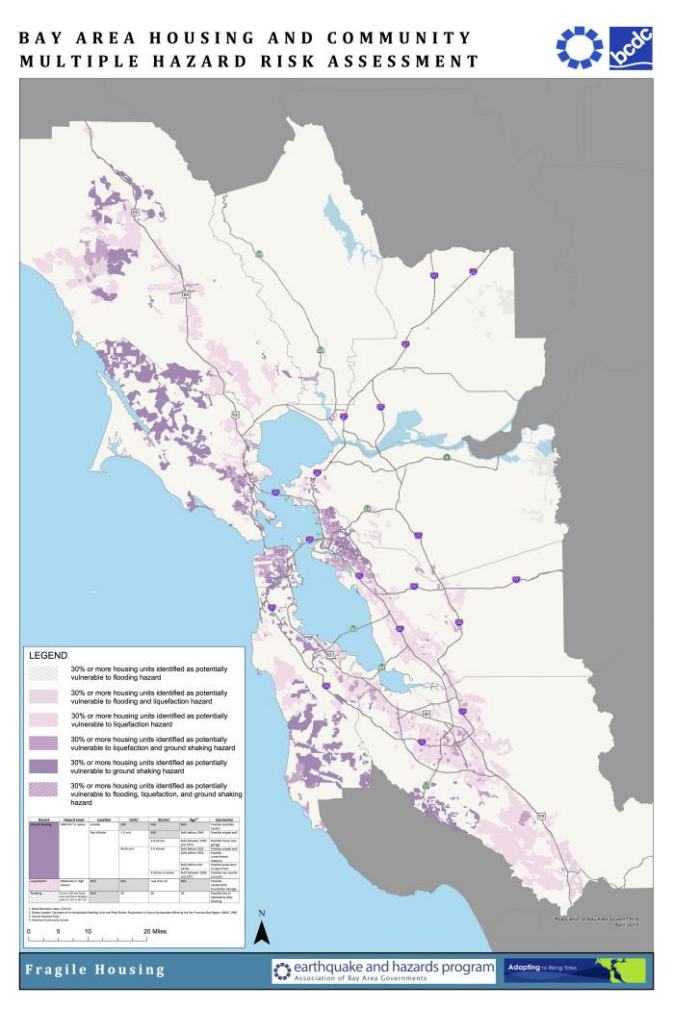
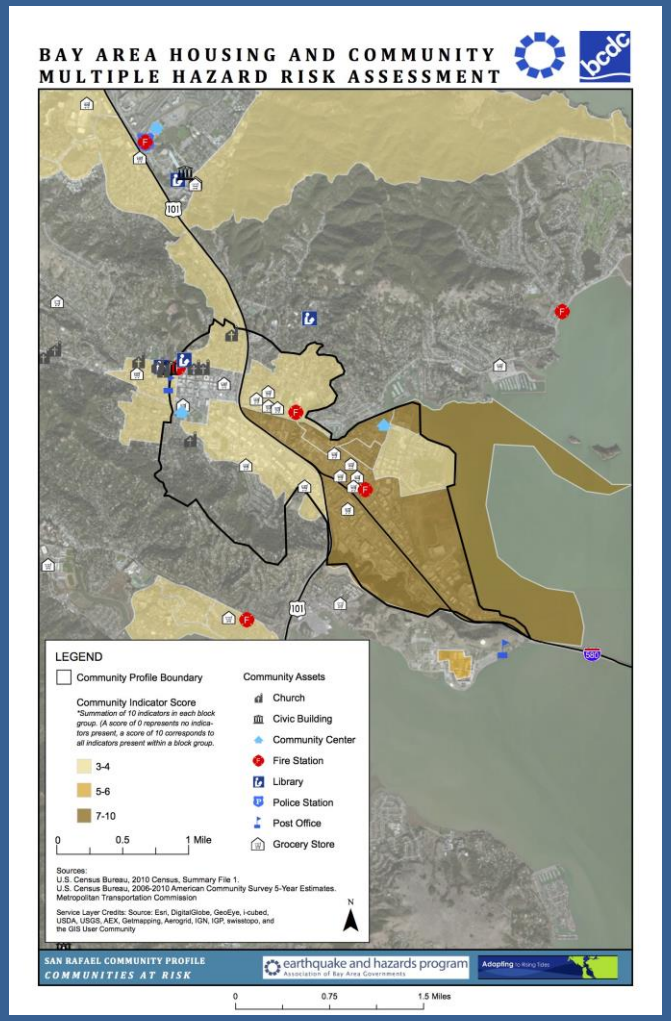
Two scales assessed: regional and community





Findings of the assessment:

- Housing is generally built to life safety rather than shelter-in-place standards
- Most foundations cannot withstand liquefaction
- Most houses cannot withstand any amount of flooding

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Findings of the assessment:

- Housing affordability is an existing challenge that will make recovery more difficult
- Renters have a limited ability to improve the resilience of the housing they live in
- Many community members have limited or inadequate information about hazards

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Housing and community strategies

- A suite of strategies to help meet resilience, sustainability, prosperity, and equity goals
- Strategies for existing housing and communities
- Strategies for new and redeveloped housing in the region’s future growth areas

Types of strategies:

- State-led strategies, such as improved mapping, guidelines and education
- Region-led strategies to address regional and cross-jurisdictional issues
- Locally-led strategies to:
  - Reduce development in high hazard areas
  - Retrofit fragile housing
  - Improve standards for new construction
  - Manage flood hazards at different scales
  - Prepare for post-disaster recovery
  - Coordinate with non-profit and community organizations

Final Web Report

http://resilience.abag.ca.gov/projects/stronger_housing_safer_communities_2015/

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RESILIENCE PROGRAM

Quick Links

[download the summary report]
[download the technical report]
[download the strategies manual]

Introduction

In the Bay Area, retaining housing, and the populations that live in housing, is crucial to expediting and ensuring an

Housing and Community Vulnerability

Hazards

The vulnerability analysis considered three hazards: ground shaking, liquefaction, and flooding. The specific hazard scenarios used in the analysis are summarized **here.**

Different earthquakes cause differing levels of ground shaking throughout the region. We selected shaking scenario maps from two previously modelled earthquake scenarios – a Magnitude 7.9 scenario on the San Andreas Fault and a Magnitude 7.0 scenario on the Hayward fault – and determined areas likely to experience ground shaking hazard levels of MMI VIII or above in these scenarios. The ground shaking hazard analysis only includes homes that are likely to be exposed to MMI VIII and greater ground shaking, as they are the most likely to be significantly damaged, thus displacing residents.

Liquefaction hazard levels were determined based on liquefaction susceptibility combined with shaking intensity (MMI). For the purpose of this project, moderate or high liquefaction hazard areas were examined using MMI from the future earthquake shaking scenario maps for the two scenarios outlined above (a San Andreas or Hayward event), as they are the most likely to cause major building damage that displaces residents from their homes.

Any amount of flooding has the potential to displace residents from their homes, as even short duration flooding can undermine building structures or create unsafe living conditions due to mold growth and contamination. Current flooding scenarios are based on published National Flood Insurance Program (NFIP) rate maps.

Future flooding scenarios are based on three regional inundation maps developed by NOAA Office for Coastal Management. These three inundation maps are used to represent future flooding from different combinations of sea level rise and tide levels.

Key Considerations

Hazards can have significant impacts on communities that live in high hazard areas

Much of the Bay Area is exposed to natural hazards that have the potential to cause significant impacts on the region and its residents. Seismic events may cause ground shaking or liquefaction, and many shoreline areas are vulnerable to existing flooding and may experience increased flooding in the future due to sea level rise.

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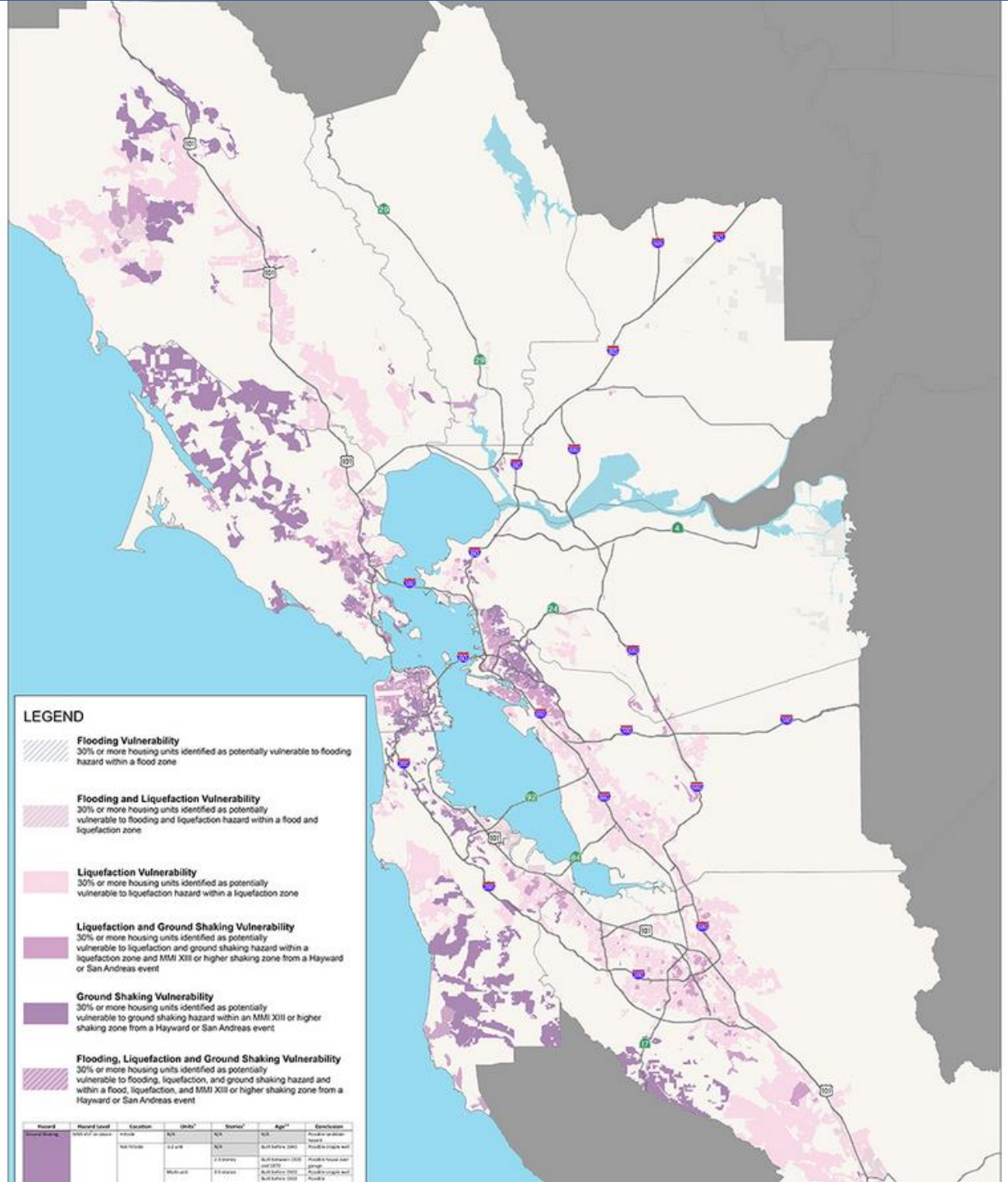
Housing Vulnerability

Regional housing vulnerability was determined based on the eight potentially **fragile housing types** commonly found in the Bay Area. The presence of vulnerable housing is indicated if 30% or more of housing units in a block group are a fragile housing type located in an area of ground shaking, liquefaction, or flooding hazard.

The fragile housing typology is designed to identify subsets of the Bay Area housing stock that are likely to possess characteristics that increase their vulnerability. This method identifies only what are deemed as the most fragile


LEGEND
Flooding Vulnerability
30% or more housing units identified as potentially vulnerable to flooding hazard within a flood zone
Flooding and Liquefaction Vulnerability
30% or more housing units identified as potentially vulnerable to flooding and liquefaction hazard within a flood and liquefaction zone
Liquefaction Vulnerability
30% or more housing units identified as potentially vulnerable to liquefaction hazard within a liquefaction zone
Liquefaction and Ground Shaking Vulnerability
30% or more housing units identified as potentially vulnerable to liquefaction and ground shaking hazard within a liquefaction zone and MMI XIII or higher shaking zone from a Hayward or San Andreas event
Ground Shaking Vulnerability
30% or more housing units identified as potentially vulnerable to ground shaking hazard within an MMI XIII or higher shaking zone from a Hayward or San Andreas event
Flooding, Liquefaction and Ground Shaking Vulnerability
30% or more housing units identified as potentially vulnerable to flooding, liquefaction, and ground shaking hazard and within a flood, liquefaction, and MMI XIII or higher shaking zone from a Hayward or San Andreas event

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Financing Mechanisms

Name	Administrator	Source of Repayment	Area of Application	Voter Approval Considerations	Applicable Strategies
City/County/ State Bond Program	City, County, Regional Agency, or State	General fund, sales tax, or hotel tax; Service fees, property tax, tax increments	Citywide, Countywide, or Statewide	General obligation bonds require two-thirds voter approval. Revenue bonds require majority voter approval.	12, 20, 26
Parcel or Sales Tax	City, County, Regional, or State	Parcel tax or sales tax	Citywide, Countywide, Region-wide, or Statewide	Parcel or sales taxes require two-thirds voter approval	None
Tax-based Special Districts	Special District	Ad-valorem property tax	Districtwide	Tax-based special districts need two-thirds voter approval to be able to levy special taxes.	5, 9, 12, 14, 17, 26, 32, 33, 38
Fee-based				Fee-based special districts do not need voter approval to issue bonds for capital generation. Similarly, fees charged by	

Conclusion

Improving resilience should focus on the intersection between fragile housing and community vulnerability. The outcomes of this project should also assist the region to actively avoid increasing the number of communities at risk while still meeting ambitious growth and sustainability goals.

Local jurisdictions are encouraged to conduct more in-depth local analysis based on this project, for example by considering the methods and outcomes of the regional analysis in their Local Hazard Mitigation planning process. Local jurisdictions can also begin using the strategies based on the initial regional analysis even without local analysis. The region can use the outcomes of this project to incorporate resilience into region-wide policies on planning for future growth through Plan Bay Area and in helping jurisdictions decide where and how to grow. Assistance implementing strategies will be provided to local jurisdictions by ABAG through its Regional Resilience Plan throughout 2015 and 2016. The suite of strategies developed by this project are not intended as a one-time effort or a complete set of tools. As communities gain more experience with assessing vulnerability and implementing strategies they may have additional insights to offer on potential actions, or recommendations for modifying the strategies recommended here. ABAG's ongoing Resilience Program is one vehicle through which new lessons at the local level can be communicated to a broader audience.

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Additional Links

Summary Report
Stronger Housing, Safer Communities

Strategies Manual
Stronger Housing, Safer Communities

Technical Report
Stronger Housing, Safer Communities

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Funding from the U.S. Geological Survey's (USGS) Earthquake Hazards Program External Research Support program leveraged additional resources from the U.S. Environmental Protection Agency's (EPA) Smart Growth Implementation Assistance program, Federal Emergency Management Agency (FEMA), and the California Strategic Growth Council